Post-acute Care

Geographic Variation in the Use of Post-acute Care

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Objective. To assess the extent and consistency of geographic differences in the use of post-acute care (PAC), and the stability of this pattern of variation.

Data Sources. The 5 percent Medicare data sample for 1996, 1997, and the first eight months of 1998 were used.

Study Design. Patterns of PAC use for various Diagnosis-related Groups (DRGs) across states (33 with enough cases per year) and census divisions were examined. The consistency of relative rankings for overall PAC use and use within defined DRGs was compared.

Principal Findings. PAC use varied substantially across regions. For example, the extent of any PAC use for stroke patients varied by 12 percentage points among census regions in 1998. The pattern of PAC use was quite consistent across years; 30 of the 36 possible Spearman rank order correlations were statistically significant with coefficients ranging from 0.35 to 0.95 among the DRGs studied. The correlations among DRGs were generally high. For skilled nursing facility use, all the correlations were above 0.5 and were statistically significant; in general the patterns were highest within medical DRGs (0.65–0.93).

Conclusions. The variation in PAC use is not a statistical artifact. It is likely the result of several forces: practice styles, supply of services, and local regulatory practices.

Key Words. Geographic variation, post-acute care, Medicare, supply effects

Background

Payments for post-acute care (PAC) represent one of the fastest growing categories of Medicare spending. Medicare post-acute care includes care provided in skilled nursing care, rehabilitation hospitals, and home health used following the patient's discharge from an acute care hospital. The growth rate for PAC services continues to outpace other Medicare covered services. Between 1992 and 1997 the average growth rates per Medicare beneficiary for care in skilled nursing facilities and home health care was 30.9 percent and 21.9

percent respectively compared to a growth rate of only 5.8 percent for inpatient hospital services (Medicare Payment Advisory Commission 1999). In 1997 Medicare expenditures on home health and skilled nursing facilities totaled $30+ billion and represented 14.5 percent of Medicare spending, but 21 percent of Part A expenditures (Health Care Financing Administration 1998). This spending growth has not gone unnoticed; several efforts are under way to rein in spending.

The Balanced Budget Act of 1997 and the Balanced Budget Refinement Act of 1999 introduced several cost containment provisions for post-acute care and continued payment reform for individual PAC modalities. These reforms included a case-mix adjusted per diem prospective payment for skilled nursing facilities; a per-discharge prospective payment system for inpatient rehabilitation using function-related groups; and a case-mix adjusted prospective payment system for home health services (Medicare Payment Advisory Commission 2000). Others have called for bundling PAC into a single payment, either combined with or separate from the initial hospital payment, but usually including any subsequent hospitalizations occurring in the period covered; this arrangement represents a sort of mini point-of-service capitation (Lee, Ellis, and Merrill 1996; Welch 1998).

Because PAC is largely the by-product of changes in hospital payment, its shape is linked to that of hospital use and payment levels. As an alternative to hospital care, one would expect that greater use of PAC would be associated with shorter hospital length of stay (LOS); but if all hospitals were actively minimizing LOS, PAC use may be associated with longer LOS because of the time required to arrange the PAC, or because of selection bias whereby those cases who experienced complications or were more acutely ill would be more likely to receive PAC. For most Diagnosis-related Groups (DRGs) hospital LOS is longer for patients who use PAC than for those who do not. (Medicare Payment Advisory Commission 1998). However, similar or shorter LOS for PAC users was noted in operative musculoskeletal conditions, including hip-related conditions (i.e., DRGs 209 and 210) (Prospective Payment Assessment

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Commission, 1996; Medicare Payment Advisory Commission 1998). One might also expect that geographic areas with higher PAC payment levels may be associated with increased PAC use and perhaps shorter lengths of stay.

The efforts to explain geographic variation in PAC usage have left unanswered questions (Gage 1999). The intensity of use of various Medicare services varies widely across the country (Wennberg and McAndrew 1996). Likewise, Medicare spending rates vary widely from one location to another (Kane and Friedman 1997). However, the debate continues about the meaning of such variation. Is it simply statistical noise or does it represent true variation. If the latter, a difference in rates does not necessarily tell us anything about what level of care is appropriate (Leape et al. 1990; Chassin et al. 1987). In addition, because some episodes of PAC include using several different forms (Kane et al. 1996), usage of individual types of PAC are not always easily examined separately.

In this study we look at geographic variation in PAC use by census division and use data from several years to test if these variations are consistent over time. We also explore the relationship of use and hospital LOS and average PAC payments.

METHODS

Source of Data

We used claims data from the 5 percent sample of Medicare's Standard Analytic Files for the calendar years 1996, 1997, and the first eight months of 1998. The data cover hospital discharges of patients with one of eight DRGs and subsequent inpatient and PAC utilization for these elderly Medicare beneficiaries. These DRGs were associated with high PAC use: stroke (14), COPD (88), pneumonia (89/90), chronic obstructive pulmonary disease/congestive heart failure (CHF) (127), hip replacement (209), and hip fracture (210/211). For fiscal year 1996, these DRGs were among the 7 DRGs with highest number of beneficiaries using PAC (Medicare Payment Advisory Commission, 1998). For the purposes of this analysis, PAC includes skilled nursing facilities (SNF), inpatient rehabilitation (REH), and home health care (HHA). Cases were excluded for the following reasons: patients were disabled or end-stage renal disease (ESRD) beneficiaries; the primary payer was not Medicare; services were paid for by a managed-care organization; patients were discharged because of death; and patients were discharged from non-PPS provider or

special unit. If more than one hospitalization occurred in a given year, the first one was used. Beneficiaries with ESRD were excluded because of the different pattern of medical care utilization. Claims of PAC use may not be complete or generated in our data if Medicare was not the primary payer or if beneficiaries were enrolled in a managed-care organization. Services initiated in any calendar year were followed across years as necessary; but each year of hospital discharges was treated independently.

Analysis

The use of PAC was examined separately for each type of PAC (i.e., SNF, rehabilitation, or home health) and then in aggregate by combining all PAC into one variable representing any PAC use. In addition, a class labeled ''combined'' was used to cover any of the various combinations of PAC services. The ''combined'' class was employed because the numbers associated with of any specific combination of PAC use were too small to allow analysis at this level.

The rules concerning the eligibility for different types of a PAC modality vary by modality. For example, home health care may constitute a direct posthospital service, but it may also be used after discharge from rehabilitation or a nursing home. Likewise, patients discharged from a rehabilitation facility can go to a nursing home under Medicare. The numbers of permutations with a course of PAC make it difficult to examine each combination. In an effort to address the total use and cost of PAC, we examined PAC payments as well as use.

PAC use was examined at 1, 30, and 60 days after hospital discharge. In each case the extent of PAC use up to that point was considered. In the case of HHA, the 1-day definition was expanded to 4 days to allow time for the first home visit. Two levels of geographic clustering were used in these analyses to look at variations. The basic analysis relies on census divisions; but where numbers of cases permitted, we also used the rates for individual states. In these instances, we eliminated those states with fewer than 75 cases per year. This procedure left 33 states for our analyses at that level. The most consistent loss was throughout the Great Plains.

A nonparametric measure, the Spearman rank order correlation coefficient, is used to investigate whether the geographical variation in PAC use is real variation or statistical anomaly. The advantage of nonparametric methods is that they make limited assumptions about the underlying distribution of variables. A disadvantage of nonparametric methods is that we will not have a well-defined model with parameters such as means and variances

included in the model. For the purpose of this analysis, however, we are more interested in understanding the level of PAC use regarding its relative position among census divisions than its absolute value. The Spearman rank order correlation coefficients are distribution-free and the ranks assigned represent the relative positions of percentage of PAC use among census divisions.

To assign the rank to each census division, the percentage of PAC use among census divisions were ranked in descending order. If the ranks were tied, the average of ranks for which they were tied was assigned. The geographical variation in PAC use was tested by the stability of geographical variation in PAC use over years and by the consistency of PAC use across conditions. To test the stability of geographical variation in PAC use over years, ranks were assigned to each census division based on the percentage of PAC use for each calendar year by DRG. Then, the Spearman rank order correlation coefficients were calculated between calendar years (1996 versus 1997, 1997 versus 1998, and 1996 versus 1998) for each DRG. The test of the consistency of PAC use across conditions uses the ranks assigned earlier. The Spearman rank order correlation coefficients were calculated between each pair of conditions for any PAC use, SNF use, HHA use, and rehabilitation use (applied to stroke, hip replacement, and hip fracture only), respectively.

RESULTS

Table 1 presents two slightly different patterns of PAC use depending on whether one looks at PAC within the first days after hospital discharge or after the thirtieth or sixtieth days. Obviously, the proportion of patients using a combination of PAC services increases with time, as does the rate of hospital readmission. The proportion of persons using nursing homes and rehabilitation appears to decline because many of these patients go on to use other PAC modalities as well, and are thus classified under the heading ''combination.'' A substantial portion of the home health cases represent the primary PAC venue after the initial hospital discharge period.

The use of PAC varies geographically. In this context, we examined the differences in the use of PAC by analyzing the proportion of hospital discharges that use PAC within 30 days after discharge. Table 2 displays the pattern of PAC use and PAC payment across the three years of data for three DRGs, stroke, hip fracture, and CHF. There is considerable variation in the proportion of cases for each DRG that received PAC services across the census divisions. In the case of stroke, the greatest variation occurred in 1998. In that year the New England

Table 1: PAC Use and Rehospitalization in the Calendar Year 1997

	No PAC	*SNF*	*REH*	*HHA*	*Combination*	*Readmission*
Stroke (N = 13,550)						
Within 1 day	39.02%	33.94%	13.05%	13.91%	0.08%	3.31%
Within 30 days	30.04%	28.24%	5.86%	18.94%	16.92%	15.51%
Within 60 days	27.56%	26.21%	3.95%	19.73%	22.47%	22.76%
Hip Replacement (N = 14,970)						
Within 1 day	18.70%	43.47%	19.72%	18.04%	0.07%	1.01%
Within 30 days	13.94%	21.18%	6.87%	21.77%	36.24%	8.06%
Within 60 days	13.33%	18.20%	6.28%	22.09%	40.11%	11.66%
Hip Fracture (N = 7069)						
Within 1 day	16.37%	63.73%	12.29%	7.57%	0.04%	1.09%
Within 30 days	10.47%	48.85%	2.73%	10.95%	27.01%	12.14%
Within 60 days	9.15%	41.19%	2.02%	11.60%	35.02%	18.38%
COPD (N = 11,657)						
Within 1 day	69.51%	11.32%	0.43%	18.68%	0.07%	1.65%
Within 30 days	57.64%	8.98%	0.31%	27.77%	5.31%	18.35%
Within 60 days	55.10%	8.78%	0.24%	28.24%	7.55%	28.38%
Pneumonia (N = 18,417)						
Within 1 day	63.21%	19.98%	0.43%	16.32%	0.06%	1.93%
Within 30 days	53.98%	17.15%	0.18%	23.00%	5.69%	16.18%
Within 60 days	51.83%	16.76%	0.17%	23.55%	7.69%	21.12%
CHF (N = 22,481)						
Within 1 day	64.17%	13.79%	0.44%	21.52%	0.06%	3.63%
Within 30 days	49.78%	11.55%	0.21%	32.89%	5.57%	23.30%
Within 60 days	46.74%	11.19%	0.21%	33.68%	8.18%	33.95%

division had the highest rate of PAC use, with 74.5 percent of cases receiving PAC services, while two divisions tied for the lowest PAC use (the East and West South Central) states, with 62.6 percent of cases receiving PAC services.

For hip fracture the rate of PAC use was much higher overall. Although the patterns are quite similar from year to year, the greatest variation occurred in 1997, when 93.7 percent of hip fracture cases in the Mountain and Pacific divisions received PAC services compared to 84.8 percent in the West North Central division. For CHF, New England had the greatest rate of PAC use each year and South Atlantic the lowest.

Table 2 also shows a similar pattern of variation in average PAC payment across census divisions. The greatest variation occurred in 1998, when the average PAC payments for stroke cases were highest in the Mountain region ($7,750) and lowest in the East South Central region ($4,815). For hip fracture cases the average PAC payment was highest for the West South Central region ($7,996) and lowest for the West North Central region ($5,067).

The relative ranking of the regions by PAC payment does not always mirror ranking in PAC use. The correlations between the rankings for PAC use and PAC payment run from −.034 (stroke) to .583 (COPD) for 1996, .243 (stroke) to .583 (pneumonia) for 1997, and −.017 (stroke) to .433 (CHF) in 1998. This difference may reflect both the intensity and type of PAC services used.

When we repeated the analysis using state-level data, we found a wider variation. For example, in 1996 the rate of PAC use for strokes ranged from 76.9 percent (California) to 60.5 percent (Kansas). In 1997, it was 82.1 percent (Washington) to 59.1 percent (Oklahoma). For hip fracture, the 1996 range was from 95.6 percent (Connecticut and California) to 74.7 percent (Louisiana); and the 1997 range was from 96.7 percent (Connecticut) to 77.3 percent (Iowa). For CHF, the pattern was more consistent. The 1997 range was from 65.5 percent (Connecticut) to 38.2 percent (Virginia); and the 1997 range was from 66.3 percent Connecticut) to 39.4 percent (Virginia).

A persistent dilemma with data on geographic variation is distinguishing real variation from statistical anomalies. One of the best tests of this difference is the stability of the patterns. Table 3 shows the Spearman rank order correlation coefficients for each DRG across the three years, organized separately by census division and by state. The coefficients are above 0.5 in all but two cases (both stroke). A third of the correlation coefficients among census divisions are 0.9 or greater, but only one of the correlations based on states reaches that level.

A similar correlational analysis of PAC payments (not shown) reveals a comparably high consistency across the years. Among census divisions all but three of the correlation coefficients were above .9 and those were .7 or higher. The coefficients were slightly lower using states as the units of analysis. For 1996–1997 five of the six were above .8; for 1997–1998 five were above .7 (the sixth was .67); for 1996–1998 four were above .7 (the others were .8 and .63).

Another way to address the variation is to test the consistency across conditions. Table 4 compares the rankings by DRG for 1997. With a few exceptions, the census divisions that are high or low on one DRG show the same ranking for the other DRGs. This relationship is tested in Table 5, which shows the correlation across DRGs for the use of various types of PAC. (For several DRGs rehabilitation is not a frequently used service and hence is omitted from this analysis.) Again, the data are presented by both census division and state. The general patterns are similar for both levels of analysis, but there are a few differences in the relative size of the coefficients and extent of statistical significance. The correlations for using any PAC vary substantially. They tend to be highest when medical conditions are compared to medical

Table 2: Variation in Census Division in the Use of Any PAC Services and PAC Payment within 30 Days for Stroke, Hip Fracture, and CHF Discharges, 1996–1998

	1996				*1997*				*1998*			
	Rank Order		*Amount*		*Rank Order*		*Amount*		*Rank Order*		*Amount*	
Census Division	*% Users*	*PAC $*	*% Users*	*PAC $*	*% Users*	*PAC $*	*% Users*	*PAC $*	*% Users*	*PAC $*	*% Users*	*PAC $*
Stroke												
Pacific	1	1	75.6%	7,743.66	1	1	74.0%	7,309.64	2	2	71.6%	7,350.80
East South Central	2	9	70.8%	3,790.23	8	9	67.4%	4,399.29	8.5	9	62.6%	4,815.55
New England	3	8	70.4%	4,861.77	2	8	73.5%	5,438.45	1	8	74.5%	5,029.41
East North Central	4	4	69.8%	5,734.53	3	4	72.0%	6,276.84	4	4	69.6%	6,611.29
Mid Atlantic	5.5	7	69.5%	5,062.93	4	6	71.0%	5,751.70	3	5	71.0%	6,477.21
Mountain	5.5	2	69.5%	6,909.00	5.5	2	70.2%	7,133.11	7	1	64.2%	7,750.41
West South Central	7	3	68.2%	6,100.42	9	3	66.7%	6,587.95	8.5	3	62.6%	7,331.43
South Atlantic	8.5	6	67.6%	5,150.85	7	7	68.6%	5,736.91	6	7	65.0%	5,781.32
West North Central	8.5	5	67.6%	5,365.73	5.5	5	70.2%	5,780.58	5	6	67.8%	6,023.19
Hip Fracture												
Pacific	1	2	93.3%	7,017.48	1.5	2	93.8%	7,023.09	1	2	92.6%	7,461.04
New England	2	6	91.7%	5,523.17	4	7	90.9%	5,539.44	5	8	89.0%	5,945.48
Mountain	3	3	90.8%	6,605.81	1.5	3	93.7%	6,824.98	7	3	87.3%	7,402.05
Mid Atlantic	4	5	89.3%	5,567.93	3	4	92.1%	6,624.55	2	4	91.1%	7,216.35
South Atlantic	5	4	89.0%	5,585.43	5	5	90.4%	6,251.79	4	5	89.2%	6,420.69
East North Central	6	7	88.4%	5,498.46	6	6	88.1%	5,949.87	6	7	87.5%	6,096.86
East South Central	7	8	86.1%	5,116.16	7	8	86.8%	5,206.60	3	6	89.7%	6,177.19
West North Central	8	9	85.9%	4,578.23	9	9	84.8%	5,015.88	8	9	85.1%	5,066.60
West South Central	9	1	85.7%	7,323.96	8	1	86.6%	7,099.26	9	1	84.4%	7,996.36

CHF												
New England	1	4	63.6%	2,073.63	1	4	63.6%	2,555.75	1	4	60.4%	2,628.09
West South Central	2	3	52.6%	2,302.27	3	2	52.4%	2,767.28	5	3	45.9%	2,713.09
Mid Atlantic	3	8	52.4%	1,755.15	2	7	55.1%	2,084.95	2	7	50.9%	2,434.70
East South Central	4	9	51.9%	1,555.07	5	9	50.3%	1,831.70	8	9	43.1%	2,152.34
Pacific	5	1	51.5%	2,818.89	4	1	50.7%	3,015.71	4	2	46.5%	2,922.31
Mountain	6	2	49.1%	2,694.74	6	3	49.3%	2,738.94	3	1	47.3%	3,250.63
East North Central	7	6	47.8%	2,008.69	7	6	48.0%	2,154.56	7	6	44.9%	2,542.14
West North Central	8	7	47.7%	1,938.07	8	8	47.9%	2,045.53	6	8	45.1%	2,237.20
South Atlantic	9	5	45.8%	2,013.48	9	5	45.4%	2,333.10	9	5	41.9%	2,558.90

Table 3: Summary Spearman Rank Order Correlations between Years for Rankings of Any PAC Use Rates within 30 Days among Census Divisions and States

	96–97		*97–98*		*96–98*	
	Census Divisions	*States*	*Census Divisions*	*States*	*Census Divisions*	*States*
Stroke	.532	.545**	.933**	.542**	.354	.358**
Hip Replacement	.962**	.663**	.711**	.652**	.567	.522**
Hip Fracture	.921**	.755**	.569	.705**	.617	.701**
COPD	.767*	.860**	.950**	.902**	.583	.809**
Pneumonia	.833**	.856**	.669*	.848**	.937**	.799**
CHF	.967**	.693**	.783*	.588**	.667*	.715**

*Significant at $p < 0.05$
**Significant at $p < 0.01$

conditions (e.g., COPD, pneumonia, and CHF), or when orthopedic conditions are compared; but they are also high between COPD and stroke. Of the 15 combinations assessed, the correlations for any PAC use were greater than 0.5 for 7 analyses at the census division level and 6 at the state level, but not always the same ones. The correlation coefficients among DRGs are universally high for SNF use. For home health they are over 0.5 for 12 analyses at the census division level, but for only 7 at the state level. However, because there are more observations at the state level, more of these coefficients are significant. They are high among the medical conditions, but they are also high for stroke and hip replacements and between stroke and CHF. In the case of rehabilitation, there is a high correlation in the use with the two hip DRGs, but much less with stroke and either hip DRG.

The use of PAC is related to hospital length of stay (LOS), but not in the way one might expect. Post-acute care use is associated with longer LOS. For example, 1997 stroke patients who had no PAC by 30 days had a mean LOS of 6.0 days, whereas those who went to SNFs had a mean LOS of 9.3 days; those who went to rehabilitation units had a mean LOS of 7.2 days and those who received home health care had a mean LOS of 6.8 days. This pattern holds for all the other DRGs except hip procedures, where the LOS for those receiving rehabilitation is shorter than that for those who did not get any PAC; for the rest of the PAC users the LOS was longer.

This relationship is reflected in the patterns within the census regions, but the message changes somewhat when the analysis uses regional means. Table 6 shows several comparisons. When the rank order of regions for average

Table 4: Rankings for PAC Use (Shown as % of Discharges Receiving Any PAC by 30 Days) by Census Divisions, 1997

	Stroke		*Hip Replacement*		*Hip Fracture*		*COPD*		*Pneumonia*		*CHF*	
Census Division	*Rank*	%	*Rank*	%	*Rank*	%	*Rank*	%	*Rank*	%	*Rank*	%
Pacific	1	74.0	4	87.3	1	93.7	2	47.7	4	50.4	4	50.7
New England	2	73.5	1	91.9	4	90.9	1	60.5	1	57.4	1	63.6
East North Central	3	72.0	8	81.8	6	88.1	7	40.9	8	43.6	7	48.0
Mid Atlantic	4	71.0	3	89.7	3	92.1	3	45.2	3	51.9	2	55.1
Mountain	5.5	70.2	6	85.2	2	93.4	5	43.9	2	56.8	6	49.3
West North Central	5.5	70.2	9	78.6	9	84.8	4	43.4	7	43.7	8	47.9
South Atlantic	7	68.6	2	91.4	5	90.3	9	38.0	9	41.9	9	45.4
East South Central	8	67.4	5	85.6	7	86.8	8	40.2	6	43.8	5	50.3
West South Central	9	66.7	7	84.9	8	86.6	6	41.3	5	45.0	3	52.4

Table 5: Spearman Rank Order Correlations of Relative DRG Rankings within Census Divisions and States for Various Types of PAC Use (within 30 Days), 1997

	Any PAC		*SNF Rates*		*Home Health Rates*		*Rehabilitation Rates*	
Correlation DRG Pair	*Census Divisions*	*States*	*Census Divisions*	*States*	*Census Divisions*	*States*	*Census Divisions*	*States*
Stroke/Hip replacement	.276	.271	.767*	.707**	.817**	.445**	−.350	.289
Stroke/Hip fracture	.592	.377*	.900**	.795**	.667*	.481**	.033	.406*
Stroke/COPD	.711*	.457**	.767*	.691**	.633	.514**		
Stroke/Pneumonia	.477	.526**	.850**	.698**	.567	.655**		
Stroke/CHF	.285	.434*	.767*	.702**	.733*	.521**		
Hip replacement/Hip fx	.552	.515**	.800**	.737**	.500	.467**	.900**	.897**
Hip replacement/COPD	.300	.341	.767*	.641**	.533	.517**		
Hip replacement/Pneumonia	.467	.267	.683*	.557**	.617	.391*		
Hip replacement/CHF	.433	.303	.667*	.544**	.650	.327		
Hip fx/COPD	.552	.364*	.817**	.753**	.267	.245		
Hip fx/Pneumonia	.561	.532**	.817**	.802**	.333	.230		
Hip fx/CHF	.301	.362*	.717*	.745**	.283	.259		
COPD/Pneumonia	.900**	.745**	.933**	.909**	.817**	.652**		
COPD/CHF	.700*	.721**	.933**	.882**	.850**	.694**		
Pneumonia/CHF	.900**	.862**	.917**	.861**	.850**	.839**		

*Significant at $p < 0.05$
**Significant at $p < 0.01$

Table 6: Spearman Rank Order Correlations Across Census Divisions of Average Hospital Length of Stay and PAC Use and PAC Payment by DRG (within 30 Days), 1997

	LOS/PAC Use	*LOS/PAC Payment (PAC only)*	*LOS/PAC Payment (including readmission)*
Stroke	−.259	−.733*	−.633
Hip procedure	.469	.134	.251
Hip fracture	−.383	−.400	−.333
COPD	−.318	−.552	−.310
Pneumonia	−.267	−.433	−.167
CHF	−.100	−.600	−.383

*$p < .05$

LOS is correlated with the use of PAC, the relationship is negative for all but one DRG (hip procedures) but not significant. When the average LOS is correlated with PAC expenditures, the same general pattern is seen; but the size of the correlations is generally larger and one correlation (stroke) is significant. When the average LOS is correlated with PAC expenditures that include the costs of hospital readmission, the same overall pattern is seen but the size of the correlations are less impressive. In summary, LOS is inversely related to PAC use and PAC payment, but the extent of the relationship is not generally significant.

DISCUSSION

This study deliberately uses large geographic regions. It is more a study of large area variation than the more familiar small area variation (Wennberg and McAndrew 1996). Using census divisions will reduce the apparent variation because the effects of individual institutions are submerged into large aggregations. Nonetheless, there is substantial variation in the level of PAC use. For example, in 1997 the use of any PAC ranged more than 7 percentage points across census divisions for stroke, almost 9 percentage points for hip fracture, and 18 percentage points for CHF.

The findings from this study are basically the same whether we use census divisions or states with adequate numbers of cases as the unit of analysis. The geographic variation in rates of PAC does not seem to be a statistical artifact. The patterns are generally consistent over time whether one considers use or payments. However, the pattern of use is not highly correlated with the overall payments nor with average LOS, probably reflecting differences in the

composition of PAC services as well as its intensity. This temporal stability is all the more remarkable when one realizes that the period covered includes the era covered by the Balanced Budget Act's changes in home health payment.

The differences in PAC use likely reflect both differences in practice styles and supply. In this case, practice styles extend beyond what individual practitioners do to include the effects of regulators, especially the fiscal intermediaries who can influence the use of PAC under Medicare. For example, anecdotal reports suggest a great discrepancy in the enthusiasm for rehabilitation for hip procedure cases from one state to another. The correlation patterns in Table 5 are consistent with a scenario that is generally permissive about rehabilitation for stroke (and hence there would be little variation in the rate of rehabilitation for stroke) but much more varied in its enthusiasm for rehabilitating hip conditions. It appears that if they favor rehabilitation for hip fracture, they also endorse it for hip procedures. This finding is consistent with the observation that many hip fracture cases are treated with hip procedures (Burns et al. 1997).

The picture is compatible with a view that both professional style and supply of services affect PAC use. The universally high correlations among DRGs for skilled nursing facility use suggest a supply effect. The relationship within hip DRGs and among medical DRGs can be interpreted to reflect different providers having an internally consistent view of how PAC should be used.

The PAC modality with the greatest variation in availability is rehabilitation. Prior work has shown evidence of substitution for formal rehabilitation, especially by using skilled nursing care (Neu, Harrison, and Heilbrunn 1989). Nonetheless, the use of skilled nursing facilities seems to be the most consistent across divisions even though the supply of such care varies considerably (Medicare Payment Advisory Commission 1998). This observation suggests that supply may be less an issue than practice standards. This conclusion is bolstered by the observation of substantial variation in the use of home health care across conditions.

Practice standards may be developed by local providers or they may be imposed by regulation or interpretation. The rules concerning the legitimate use of different types of PAC vary somewhat among the modalities. For example, rehabilitation after hip replacement is not universally viewed as needing formal rehabilitation. In a related vein, the same service may be viewed as both a hospital substitution and a continuation of another PAC venue. For example, home health care may constitute a direct post-hospital service, but it may also be used after discharge from a rehabilitation hospital or a nursing

home. Likewise, patients discharged from a rehabilitation facility can go to a nursing home under Medicare. Thus, summing up total PAC use or a given venue may include its employment as a direct discharge location and its use as a secondary PAC service. The number of permutations within a course of PAC makes it difficult to examine each permutation and combination separately.

Research should be continued to develop best-practices and treatment protocols for post-acute care with an aim at improving quality of care (Kane et al. 2000; Chen, Kane, and Finch 2000), and this information should also be incorporated into a rational payment policy for Medicare PAC based on the costs of the most effective modes of care.

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